DOCUMENT RESUME

ED 272 537 TM 860 453

AUTHOR Berryman, Sue E.
TITLE Education and Employment: Substitution Possibilities and the Teacher Labor Force: Supply and Demand.
SPONS AGENCY National Center for Education Statistics (ED), Washington, DC.
PUB DATE 21 Jun 85
NOTE 19p.; In: Invited Papers: Elementary/Secondary Education Data Redesign Project, October 1985; see TM 860 450.
PUB TYPE Viewpoints (120)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Career Education; *Data Collection; Educational Research; Elementary Secondary Education; *Information Needs; Job Placement; *Job Training; Labor Market; National Surveys; Occupational Mobility; Occupational Surveys; On the Job Training; Research Needs; *Teacher Effectiveness; *Teacher Supply and Demand
IDENTIFIERS National Center for Education Statistics

ABSTRACT

Two major discussions are combined in this paper: (1) learning opportunities, vocational skills, and access to occupations; and (2) data on teachers. Data and analyses are needed in such areas as the supply of scientific and computer personnel to determine oversupplies or shortages, and the relationship of corporate training to other sources of education. It would also be advisable to examine the assumptions underlying federal job training and retraining programs; perhaps retraining is not necessary if the problem is really lack of jobs or low wages. It is not necessarily true that an occupation requires a particular set of job skills and training; skills may be interchangeable, and training may come from a variety of sources. Although this type of research should be conducted in laboratory experiments or observational studies, the National Center for Education Statistics (NCES) and other agencies can provide longitudinal data on sources, amount, and subjects of training, and characteristics of work experience. The second part of the paper discusses the need for data to study teachers and teacher quality. NCES should play a central role in data collection. Data sources include schools and local boards of education, state agencies, practitioners' and policymakers' associations, and statistical and research organizations. (GDC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED272537

EDUCATION AND EMPLOYMENT: SUBSTITUTION POSSIBILITIES AND THE TEACHER LABOR FORCE: SUPPLY AND DEMAND

Dr. Sue E. Berryman
The Rand Corporation
Washington, D.C.

June 21, 1985

This paper was prepared for the Elementary and Secondary Data Redesign Project of the National Center for Education Statistics.

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

S. Mauchamer

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

TM 860 453

SUBSTITUTION POSSIBILITIES IN EDUCATION AND EMPLOYMENT, OR: IT MATTERS IF THERE IS MORE THAN ONE ROAD TO MANDALAY

INTRODUCTION

Key to answering an astonishing number of policy questions is understanding two relationships. *What is the relationship between alternative learning opportunities and the acquisition of skills?* Specifically, what learning opportunities--different types of formal education, leisure activities, and work experiences--are interchangeable with each other in producing skills, and under what conditions?

And, *what is the relationship between the nature of skills and access to occupations?* How does the array of skills that individuals possess map onto the array of occupations, as evidenced by employment in the occupation? How do tight versus loose labor markets for the occupation change the mapping? How does the nature of the employer's job structure affect the mapping--for example, a structure with fairly rigid, narrowly-defined job categories versus one with broadly defined categories? How does the "age" of the occupation (emerging or established) affect the mapping?

The National Center for Education Statistics (NCES) and other agencies now collect data that allow limited analytic progress with these questions. However, as discussed in more detail later, current longitudinal data bases do not approach their potential for supporting research into these issues.

Answers to these two questions can illumine a surprising range of policy issues. I discuss three examples here: shortages and oversupplies of skills; the contribution of formal corporate training to the human capital of the labor force; and theories of labor markets that underlie federal training policies for disadvantaged individuals and dislocated workers.

ROLE OF INTERCHANGEABILITY IN EDUCATION AND EMPLOYMENT POLICY

Skill Shortages and Oversupplies

Policy concerns about oversupplies or shortages of particular skills--scientists, engineers, or public school teachers, for example--are hardy perennials. These concerns, often escalated to statements about "crises," include concerns not just about shortages or oversupplies of skills, but also of those who produce them--for example, of mathematics and science teachers at the secondary level and science and engineering faculties at the post-secondary level.

These "crises" presume that shortages or oversupplies matter. However, we lack data and analyses to determine if and when they matter, for whom, and in what way. For example, do shortages of computer

science teachers at the post-secondary level affect the supply of computer skills that employers need, and, if so, for all or for specialized skills only? Are there alternative sources of instruction? In the computer case we know that students in all of the highly quantitative fields gain experience with computer-based equipment and software. In fact, one of the explanations of the heterogeneous backgrounds of those employed in computer science jobs[1] is that opportunities to learn the skills required for these jobs are widely diffused among academic departments.

How do employers and individuals trained in an oversupplied field respond to oversupplies, and what costs do these responses exact? In other words, *do we need to worry about oversupplies?* Which subgroups tend to absorb the costs of oversupplies? Those newly trained in the occupation? Those approaching retirement? How does the accommodation occur? Under what conditions do employers offer and individuals accept lower wages? When do employers ratchet up the education that they require of new hires without changing the skill content of the job? Are individuals who accept such jobs underemployed, or do they tend to "upgrade" the work performed to match their skills? How often do trained individuals leave their field of training? Do they tend to enter fields that use some part of their past educational and work experience? Are these individuals permanently lost to the field in which they were trained, or do they tend to migrate back into it as supply and demand for the field equilibrate?

How do employers respond to shortages of individuals trained in a specific field? In terms of educational and work backgrounds, how *wide* a net do employers seem willing to cast to fill positions? How low in the *level* of training in the shortage field (e.g., ratcheting down from an M.S. degree to an B.S degree) do employers seem willing to go? What are the consequences of staffing jobs with less advanced or less germane training? How "tolerant" are different occupations of variations in skills, i.e., how wide a spread of skills can they accommodate before productivity declines? How do discrepancies between the skills required and those hired become resolved? Do occupants of jobs learn the skills required or do they transform the job to fit their skills?

A study of how employers staffed three electronic data processing (EDP) occupations (computer operators, programmers, and systems analysts) between 1965 and 1970 illustrates employer responses to shortages in an *emerging* occupation.[2] The authors found that a third of the 1970 EDP labor force had been employed in EDP occupations in 1965; a third had entered the labor force since 1965; and a third had worked in non-EDP occupations in 1965. The majority of the lateral transfers did

---

[1]Table B-8, National Science Foundation, *Characteristics of Recent Science/Engineering Graduates:1982,* Report No. NSF84-318, pp.23-24, U.S. Government Printing Office, Washington, D.C., 1984.

[2]Sheldon Haber and Robert Goldfarb. "Labor Market Responses for Computer Occupations," *Industrial Relations,* 17 (1), 53-63, February, 1978.

not come from disciplines and occupations related to EDP occupations: only 30.2 percent of these transfers had been engineers, mathematicians, life and physical scientists, engineering and science technicians, accountants, bookkeepers, and office machine operators. Thus, in the EDP case, workers in *unrelated* fields constituted an important part of the labor response to rapidly growing demand.

The data on supply sources showed that entry into the more complex EDP fields, such as systems analyst, required more occupationally-germane formal or on-the-job training. In general, however, the data showed that formal education (e.g., a college degree) could substitute for work experience, that formal education could substitute for vocational training, and that less experienced workers needed more formal education if they lack vocational training.

The EDP occupations were not established occupations in the 1960's, and employers' responses to shortages in these occupations may be a special case, i.e., not germane to how employers handle shortages. Higher skill occupations that are new are not well integrated into educational and employment systems. They lack generally understood entry paths (training sequences, school-work transitions, career ladders) and developed training programs. Their job content tends to be unstable, making it difficult to design relevant educational programs. Thus, de facto, they are higher skill occupations with low entry barriers-- "bright," i.e., "trainable," individuals can enter them relatively freely.

Corporate Training and Human Capital

Although we know more about formal corporate training today than we did ten years ago, we still lack systematic information about which employers provide what kinds and how much training to what kinds of employees for what purposes and with what effect. Thus, the relationship of corporate training to other sources of education and training and its contribution to the human capital of the labor force are not well understood. Does corporate training complement or duplicate other training sources? Total corporate investments in training may be large. However, does a large dollar total translate into substantial changes in human capital? Or does corporate training augment human capital only marginally--either in the sense that the training time *per employee* is so short that little could be learned or the substance of the training has minimal transferability (e.g., company safety procedures)?

Not knowing what role corporations play in creating human capital is like misspecifying a model. Or, using another analogy, it means working with a map of the education and training system that contains a sizeable *terra incognita*. Maps of this kind can produce at least two kinds of diagnostic errors. Those using the map can assume that the unknown domain is "picking up" training not performed in the known parts when in fact it is not. Or they may simply ignore the unknown part. In this case they will underestimate the amount and types of training being conducted, potentially funding training that simply duplicates what employers are already buying.

Federal Training Programs and Images of Labor Markets

The federal government has invested billions of dollars in training and employment programs for various disadvantaged groups. These programs are predicated on (often unspecified) assumptions about relationships between skills and jobs. Are these images of the labor market correct?

In the early 1980's computer-based changes in the economy's technological base and realignments of international markets combined with a recession to displace a large number of experienced workers. As in the early 1960's, these events generated considerable policy discussion about retraining programs. This solution presumes that the problem is a lack of skills for available jobs, rather than a lack of jobs (regardless of the available skills), or low wages for available jobs for which dislocated workers qualify. Since fragmentary evidence indicates that individuals move fairly freely among less skilled jobs *apparently* without additional training, the dislocation problem is not necessarily a retraining problem.

Conclusion

Key to answering these and other questions is understanding interchangeability among sources of skills and how skills map onto occupations. In the United States we tend to assume that a particular occupation requires a unique bundle of skills, obtained from limited sources. This assumption affects curricular design and feeds, if it does not produce, anxieties about skill shortages and oversupplies. If individuals can only obtain required training from highly limited sources, they cannot adjust to shortages in the supply of these sources. If occupations require distinct bundles of skills, they operate like countries with trade barriers. Goods cannot move freely among nations--or, analogously, labor cannot move freely among occupations to adjust to changes in demand.

In fact, fragmentary but internally consistent empirical evidence indicates that this assumption reflects a mechanistic and fundamentally inaccurate view of human cognitive capacities, the educational system, the effects of schooling, and the nature of jobs. Substitution possibilities pervade the educational system and the work place.

At least some of the same skills can be obtained in alternative ways--in different courses, from different schools, during military tours, in civilian jobs, or from volunteer or avocational activities. Substitute sources of knowledge can vary in degree and number, depending on the knowledge in question. Two alternatives may be complete substitutes, i.e., virtually indistinguishable from each other, or only partial.

In the labor force different jobs can be filled with individuals who have more or less heterogeneous educational and occupational backgrounds. Again the substitutes vary in degree and number, depending

on the job in question. Fragmentary data suggest considerably more interchangeability, even for high skill jobs, than we commonly assume, especially for the newer occupations that technological innovations tend to spawn. The substitution possibilities, not surprisingly, seem greater for less demanding skills, such as computer programmer, than for more demanding ones, such as computer systems analyst. However, the data show that students move between post-secondary fields of study and that even highly skilled workers move between high skill occupations. The movement is not unconstrained, but there is movement.

DATA REQUIREMENTS

NCES is not the appropriate organization to collect the data required to answer some of the questions posed here. For example, laboratory experiments or observational studies are probably preferred to survey techniques for studying the processes by which employees accommodate discrepancies between job skills required and those possessed.

However, the NCES and other federal agencies such as the Department of Labor and the National Science Foundation support certain data collection activities that could support progress on substitution questions. These are longitudinal data bases that measure characteristics of workers' formal education and training, their work experiences, and their movement across time among occupations, firms, industries, and geographic areas.

Existing longitudinal data bases--two of them funded by the NCES--contain some information on the critical variables: for example, *The National Longitudinal Study of the High School Class of 1972; High School and Beyond; The National Longitudinal Surveys of Young Men, Young Women, Mature Women, and Mature Men; The National Longitudinal Survey of Youth Labor Market Behavior; Panel on Income Dynamics;* and *Experienced Scientists and Engineers.* However, these data bases all lack the detailed *taxonomies* of educational and work experiences required for completely satisfactory analyses of substitution issues. Carefully developed taxonomies are critical to the success of these measures. Examples of taxonomies that would have to be developed are:

- the *sources* of formal training, such as vocational training in an area vocational high school, vocational training in a comprehensive high school, the military, an avocational activity with some kind of formal instruction, corporate training delivered outside of formal educational institutions, corporate training that uses formal educational institutions (by type of institution), a public two-year college, a post-secondary proprietary vocational school, a four-year college, a university, a corporate college.

- the *subjects* of formal instruction, such as particular courses in mathematics or computer science, a course in using a company's text processor software, a finance course.

- the *amount* of formal training, such as two versus four years of high school mathematics, a two year associate degree program versus a four year B.S. degree, a four year versus a five year B.S. program in engineering, a week versus six weeks of management training.

- *characteristics* of the work experience that measure development and deployment of skills: for example, the Census 3 digit occupation, the technology (-gies) used in the job, the nature of supervisory responsibilities, time diaries--similar to those used to measure work in the home--to measure routine and periodic work activities.

KNOWLEDGE ABOUT THE NATION'S TEACHERS, OR: YOU'VE LOST THE WAR IF YOU CAN'T FIND THE BATTLEFIELD[1]

INTRODUCTION

In 1982-83 the nation's public elementary and secondary schools employed over 2 million classroom teachers. This labor force is almost exactly the same size as the nation's active duty enlisted force and officer corps. In terms of the number employed, the elementary/secondary teaching occupation is the largest professional and technical occupation and among the five largest white collar, blue collar, and service occupations.

The public and private cost of creating and employing this labor force is enormous. Last year the nation spent over *one hundred billion* dollars on public elementary and secondary schools, over fifty billion of these dollars going to teacher salaries. Since almost all public school teachers have at least a bachelor's degree and half have at least a master's degree or 6 years of post-secondary education, the size of this labor force represents an enormous public and private investment in human capital.

However, despite the tremendous cost of creating and employing public school teachers, we know almost nothing about how many teachers we will need, when, at what levels, in which disciplinary fields, and in which parts of the nation. We do not know if the publicized shortages of mathematics and science teachers are general shortages or spot shortages. Current efforts to improve supply and demand projections are being severely limited because we lack the fundamental information required to predict supply and demand.

More important than the costs of creating or paying it, this labor force develops a substantial part of the human capital in each new generation of children. Those 25-29 years old in 1980 had completed a quarter of a million years of education, *89 percent of these years at the elementary and secondary levels*. Elementary and secondary public school teachers particularly affect poor children: these children are more apt than non-poor children to receive their education in public schools, they are less apt to have well-educated parents and thus rely more heavily on teachers for their academic training, and a larger proportion of their total years of education occur in elementary and secondary schools.

However, despite the consequences of teachers' job performance for the human capital of the country--especially for that of certain subgroups, we have no acceptable data on the quality of new or experienced teachers. For example, we know that the decline in SAT

---

[1]This section is based on work conducted for Edward J. Meade, Jr., of The Ford Foundation.

scores of new teachers in the last decade is greater than that for the total population of SAT test-takers, but we do not know the relationship between score declines and teaching performance. We have no way of assessing the truth of the speculation that schools are adjusting to presumed shortages of teachers by resorting to poorly qualified individuals.

REFORM OF THE TEACHING FORCE

A blizzard of recent reports on American schools calls for reform in our public schools to improve the quality of the education that our children receive. These range from *A Nation at Risk*, issued by the National Commission on Excellence in Education, to the study conducted by the Carnegie Foundation for the Advancement of Teaching, *High School*. These reports identify our teachers as part of the problem and potentially as part of the solution.

Partly in response to these reports, state after state has legislated or is contemplating legislation that will affect the teaching force. These bills will not only affect the requirements for teachers, but also the flows of individuals into and out of teaching. Thus, ultimately, they will affect the stock of teachers--their number, field of teaching expertise, and quality. These reforms range from salary increases to changes in high school graduation requirements to competency tests for teachers.

This flurry of legislative activity reminds one of the blind man and the elephant. Educational reformers have hold of different parts of the animal--the tail, an ear, or a tusk, and each believes it to be the whole animal. In fact, the teaching labor force is a dynamic, human resource system. At any point in time, the stock of teachers--their numbers, their specialized skills, and their quality--reflect numerous prior decisions by individuals. These choices include the decision to train as a teacher or not to train; to train as a high school teacher or as an elementary school teacher; to train as a bilingual or as a foreign language teacher; to enter teaching or not to enter teaching; to stay in teaching or to leave it for home responsibilities or another occupation in the labor force; to stay in teaching or to retire; to stay in the same school or to move to another school, another district, or another state; to re-enter teaching or not to re-enter teaching. These choices are not random, any more than choosing to enter, stay in, or leave any occupation--lawyer, secretary, manager, chemist--is random. They reflect the relative attractiveness of the occupational alternatives available to the individual. As teaching becomes less attractive relative to these alternatives, the number and quality of individuals who elect to enter and to stay in teaching declines.

Educational reforms, undertaken for whatever reason, will intersect with individual choices and change the teaching force in many ways. However, *when this labor force is not conceived of as a system, when the data do not exist to diagnose problems with this system at appropriate policy-making levels (national, state, or district), and when the data do not exist to monitor, let alone project, how particular reforms*

affect the behaviors of potential, new, and experienced teachers, we are flying blind. Under these conditions the chances of misdiagnosing problems are high; the chances that reforms will produce the changes that reformers want are low. As we learned so bitterly in the 1970's, failed social reforms carry very heavy costs. The greatest is that the problems are not alleviated, while the fickle political mood that created the opportunity for reform has dissipated. Cynicism about the responsiveness of schools and teachers to national concerns deepens, and the political will to "try again" lessens. Finally, reforms, whether successful or unsuccessful, perturb the system, and turbulence is costly.

DATA ON THE TEACHING FORCE

Thus, while we need action, it needs to be informed action. However, the state of the data required for informed action is, quite simply, shocking. This is especially true when we compare our information about teachers with that which we have on labor forces of comparable size, national importance, or human capital, such as the enlisted armed forces or the scientific and engineering labor force.

Data Needs

The questions that the public and educational policymakers ask about the teaching force indicate that they want information on at least six dimensions of supply and demand. These are:

1. the quantity, or *number,* of teachers;

2. the *quality* of teachers;

3. the number and quality by *level,* a level being defined as a grade category (such as the grades 4-6) that requires at some teacher skills not required by other categories;

4. the number, quality, and level by *field,* field being defined as the teacher's special field of training, such as mathematics, bilingual education, biology, English, or art;

5. the number, quality, level, and field of teachers by their race and ethnicity; and

6. the number, quality, level, field, and race and ethnicity of teachers by their *geographic distribution,* the geographic units of interest being districts, states, and the nation and unique supply and demand environments, such as inner city schools or rural schools.

The reasons for assessing the number and quality of teachers are self-evident. The level and field distinctions presume that teachers are not entirely interchangeable with each other. The extent to which teachers with different educational and experiential backgrounds can properly substitute for each other in the classroom is an empirical,

critical, and unresolved question. However, we can safely assume that not all levels or fields are interchangeable with each other.

The racial and ethnic characteristics of the teaching force are politically, perhaps pedagogically, and, in some states, legally important. Although it is easier to measure the racial and ethnic characteristics of supply than of demand, court orders define demand for districts legally required to balance the racial and ethnic composition of students and faculty. These tend to be Southern districts. In other districts the racial and ethnic composition of the students probably establishes a demand "range" for teachers of a particular race or ethnicity.

The geographic dimension is extremely important. The nation's public schools vary greatly, and the possibilities for quality variations, geographically-specific teacher supply and demand imbalances, and resultant educational inequalities among school districts and states are enormous.

Data Sources

There are four fundamentally different sources of data on teachers. One source is organizations directly responsible for the delivery of public elementary and secondary education. These include schools and local boards of education. The second source is public administrative and legislative groups at the state level, such as state education agencies, state boards of education, and education committees in state legislatures.

The third source is associations--groups whose membership consists of particular categories of education practitioners and policymakers. These include teachers' organizations, such as the National Education Association and the American Federation of Teachers; associations of teachers of particular subjects, such as the National Science Teachers Association, National Council of Teachers of English, and the American Vocational Association; chief state school officers (the Council of Chief State School Officers); and associations that represent schools in particular environments, such as the Council for Great City Schools.

The fourth source is organizations whose primary or sole function is data collection or analysis and whose substantive focus includes education. These groups, fundamentally non-partisan, may be public or non-profit. They include organizations such as the National Center for Education Statistics, the Bureau of Labor Statistics, the Bureau of the presumed to imply quantity considerations only. However, the Census, the Rand Corporation, the Urban Institute, Educational Testing Service, and the National Center for Education Information.

Status of Data on the Teaching Force

State and local data. Interviews with the first two sources (state and local organizations) and with groups in the third and fourth categories about data from the first two sources indicate the following problems with data collected by schools districts and the states.

- In general, teacher data at the district and state levels are, in the words of one knowledgeable respondent, "deplorable," "spotty," and "inconsistent."

- All states collect data from their districts on the number of student enrollments and the number of teachers. These data are usually--but not always--collected by level (elementary versus secondary). They also usually have data on education revenues and expenditures by categories, but use such different definitions of what constitutes revenues and expenditures that these data are usually non-comparable across states.

- A few states, such as Florida, Illinois, and New York, routinely collect other data about teachers. For example, Illinois and Florida conduct supply and demand studies for their states and collect the data required for fairly simple models. However, data such as these are usually not comparable across states because the definitions of variables differ.

- Our interviews suggest that districts often have data about teachers. Since these data are almost never used for analytic purposes, we do not know how district data vary in their accessibility, quality, comparability, or temporal and substantive coverage. The few cases where researchers have tried to use district data about teachers suggest that, although the data exist, it is a major task to get them to the point where they can be used to answer questions about the district's teaching force. The data are scattered or not compiled. Our experience with data of any kind collected at local levels strongly suggests that district-level data will not be comparable across districts. It also suggests that the quality and temporal and substantive coverage will be spotty.

We tried to identify the conditions that encourage states and districts to collect teacher data. Our respondent interviews stunningly revealed why good data about teachers are not routinely collected by states and districts. *In most states the key actors do not conceive of public education as a major enterprise whose efficiency and quality might be improved if they knew more about it*--for example, if they knew more about inputs (such as teachers or laboratory facilities), tradeoffs between inputs (such as more teachers versus modernized laboratories), and about how inputs get used. As a result, they do not see the need for teacher data.

Essentially, districts and states only collect data in response to specific incentives--a behavior pattern that produces the "spotty" data collection on which so many have commented. For example, most districts collect data on enrollments or the number of handicapped students because state or federal aid is contingent on them. Other data are collected in response to mandates from state legislatures, state boards of education, or state departments of education. These mandates spring from particular interests of legislators or administrators or from national concerns about the health of education that find voice at local and state levels.

These state and district behaviors are not surprising. States do not collect data for several reasons, the philosophically and politically most important being that Americans see education as primarily a local prerogative and responsibility. Although the balance of power between the state and local levels varies within a state and from state to state, public education is still generally locally controlled. Since policymakers at the state level usually have very limited power to act on any data that they might collect, they tend not to collect much.

Other reasons that states do not collect teacher data are often related to the same issue--the distribution of power among the local, state, and federal levels of government. These include state staffs too small or not competent to collect data, no pressure to collect data ("no mandate"), or the fear that data will make their educational system look weak. States stop collecting data that they once collected because the actors change--those responsible for mandating data collection leave office, or because policy questions that led to the initial collection of data have been answered.

At the district level, there are *economies of scale problems* that reduce *district* incentives to collect and analyse teacher data. Quality data bases on teachers require substantial resources, especially at the front end. Essentially, although some districts employ thousands of teachers, most districts are small employers. Empirical studies show that firms have very different investment behaviors, depending on their size. For example, small companies are much less apt to run formal training programs for their employees.

These studies suggest that we are more likely to find good teacher data in the very large school systems than in the smaller ones. We suspect that, implicitly, administrators of smaller districts tend to think that they would not get enough return to warrant the cost of designing and maintaining a data base. For example, they may make some kinds of decisions only infrequently. Or the number of individuals affected by any given decision is small. Or the district is so small that administrators know what is happening through personal contact and can keep the relevant data in their heads. Or as one of often hundreds of districts in the state--and of thousands in the nation, the district may have limited control over issues that they care about, thus reducing the incentives to collect data germane to these issues.

Data from associations and statistical and analytic groups. We reviewed what data exist from these sources for estimating the six dimensions of current and projected teacher supply and demand. This review revealed the following data problems.

1. *We have no data from any source on certain variables.* There are no data that can be used in any serious way to assess the quality of new or experienced teachers. We have no data on the geographic mobility patterns of *new* teachers--where they look for jobs and how far and where they move to take a job. Although we have old data on the rates at which experienced teachers change schools, districts, or states in which they are teaching, we lack even old data for converting these aggregate rates into flows between specific states and districts.

We have no data on teacher benefit packages. Thus, we do not know what is in these packages, how they vary, or how transferable components such as retirement benefits are across school districts and states. Any serious estimate of the total compensation package for teachers needs to include non-wage benefits. Although we have data on whether districts offer special monetary incentives, we do not know amounts or probabilities of receiving these payments. The amounts or chances of receiving them may be so small that they can be discounted as incentives and ignored in estimating compensation packages.

2. *We have only very old data.* We have only old data for some variables, but changes in factors that affect teacher supply and demand, such as changes in the relative attractiveness of teaching, make these data obsolete. For example, data on teacher turnover are 15 years old.

3. *We have no time series on the variable.* One of the best ways to assess the effect of a new policy is to look for changes in the variable in question *after* the introduction of the policy. These assessments require measures of the variable before, as well as after, the new policy is introduced--and preferably measures at several time points before the policy change. We rarely have comparable measures of a variable across time.

4. *We have data, but from different sampling frames, differently worded questions, and different time periods.* These non-comparabilities make it impossible to pool available data to increase the statistical precision of "snapshot" (cross-sectional) estimates or to create a time series.

5. *We have only partial data.* This problem arises for most variables of interest. We will have data on some issue, such as the age structure of the teaching force or salaries, but lack these data by important distinctions such as level (elementary or secondary, for example), field (such as mathematics or English), or for different administrative units (nation, state, district, school). There is tremendous, policy-relevant heterogeneity in the teaching system, and having data for the total force without these distinctions renders them almost useless.

6. *The sources of data are not credible.* When groups with political interests collect the data, even if these data are entirely valid, they remain suspect. The National Education Association is the only source for many data on teachers--salaries, for example, and for several variables measured in their survey of the *Status of the American Public School Teacher,* such as working conditions and job satisfaction. These data seem professionally collected and reported. However, the NEA is a stakeholder in policy debates, and their data are not necessarily seen as trustworthy.

7. *The measures have validity problems.* Important measures whose validity is questioned are the measures of teacher shortages and out-of-field teaching. Recent national survey data on these variables do not indicate serious shortages even in the fields of mathematics and science; they show low rates of out-of-field teaching. These data do not fit what many think is happening in schools. A source of the discrepancy between data and impression lies in the definitions of the key concepts. For example, these data refer to "shortage" defined as unfilled job vacancies. However, what many mean by "shortage" is an inadequate supply of *appropriately trained and experienced* teachers. Data will not be trusted unless those who need them agree on the measurement system behind the data--on the definition of the concept to be measured and on its operationalization, as embodied in a specific measure.

8. *Required data may exist, but their potential for supply and demand analyses of the teacher labor force has not been assessed.* For example, the Bureau of Labor Statistics of the Department of Labor collects data on separation rates by occupation and reason (e.g., retirement). Can these data be used to estimate teacher turnover rates and post-exit destinations? What are their limits? The Census Bureau collects data on geographic mobility by occupation. Can these data be used to estimate flows of teachers in and out of geographic areas?

9. *The current data system seems inefficient.* For example, the National Center for Education Statistics, Equal Employment Opportunity Commission, and Office for Civil Rights send separate surveys to the same respondents. A single, longer survey would eliminate non-comparabilities introduced by different agency procedures and different data collection times. A consolidated survey should also reduce the burden on respondents. In other cases the same data seem collected at state and district levels, but data collected from districts can be aggregated to yield state estimates.

THE ROLE FOR THE NATIONAL CENTER FOR EDUCATION STATISTICS

In this section we describe why we think the the primary responsibility, authority, and resources for collecting data on the nation's teaching force should reside in the NCES. We also describe roles other organizations might play in conjunction with the NCES.

Why Vest Data Responsibility in the NCES?

The National Center for Education Statistics, or the NCES, is the nation's federal data center on education questions--public and private; elementary, secondary, and post-secondary; student enrollments, dropouts, and graduates; revenues and expenditures of public schools;. institutions and teachers.

The function performed by the NCES has been performed by the federal government since the nineteenth century, although this function has been vested in differently organized units with different names. In fact, the main rationale for the old Office of Education and its organizational predecessors was the collection and dissemination of statistics on education. Although NCES currently lacks a cogent vision of what data should be collected about teachers, it operates in the non-political and professional tradition of the U.S. Census Bureau and the U.S. Bureau of Labor Statistics (BLS). Just as the politically sensitive monthly unemployment figures released by the BLS are considered independent of the political party in power, so NCES data are considered independent of the many stakeholders in education.

Thus, the NCES meets three criteria for an adequate data system about teachers. First, positioned at the federal level, it is formally authorized to work with all of the nation's school districts and states. Second, it receives an annual Congressional appropriation of funds to be used for the express purpose of collecting data about education, including data about teachers.

Finally and perhaps most important, it is independent of the many stakeholders in education. To be used, data have to be trusted. Their collection and analysis must be and *must be seen to be* non-partisan. If a group with a political stake collects the data, no matter how valid the data are, they will be perceived as compromised.

By virtue of its federal position, the NCES is independent of any state or district. It is independent of the many associations in education. It is subject to the balance of power that affects all federal agencies. Finally, it is included in the special agreement struck between the Congress and the Executive Branch about the importance of non-partisan data on issues of national import. This agreement, although it has to be defended periodically, has created an independent, non-partisan status for the federal statistical agencies.

It can be argued that since states and school districts make most of the decisions about the educational system, they, and not a federal agency, are the logical units for collecting data on teachers. We argue that there are several compelling reasons to keep the basic data collection at the federal level. First, for reasons specified earlier, most states and districts have historically collected only minimum information about the elementary and secondary public school system, including teachers. We have no reason to think that the conditions that discourage data collection at these levels will permanently change in all states.

Second, many public education issues require data comparable across states. The issue may involve geographic units larger than an individual state--for example, estimates for the nation or for a category of states, such as the sunbelt states. Or it may require the ability to differentiate general from state-specific problems.

For example, many issues, while not federal, are framed as national issues, i.e., true for all states. Most recently, these include the quality of secondary education and shortages of mathematics and science teachers. Without comparable district and state-level data, national study commissions or federal policymakers cannot distinguish general from dramatic, but localized, problems. The legislators of a specific state or the board of education of a specific community cannot determine when something, while generally true for the country, is not true for them.

Thus, if states or districts are the sources of teacher data, *the data have to be comparable across states or districts.* Although in theory procedures could be established that would yield comparable state or district data, in practice this becomes a formidable task for more than a *very* few standard variables.

Third, states and districts cannot obtain data on certain key teacher supply and demand questions. These are questions that involve *relationships* between states--for example, questions about the geographic mobility of newly trained and experienced teachers--and individuals not employed by a state's school district--for example, questions about factors that affect undergraduates' choices of fields of study or the decisions of those in the reserve teaching pool to enter (re-enter) teaching.

Fourth, states and districts are not necessarily the best agents for collecting sensitive data from teachers in district or state employ. For example, teachers may be reluctant to report their job satisfaction, retirement plans, or plans to change occupations if the data are collected by their employers.

Role for Other Groups

An adequate data system about teachers must provide the data that all of the nation's major users require. These users include those with public responsibilities for elementary and secondary education and large interest groups with legitimate political objectives. In other words, they include users at different levels of government--national, state, and local, such as state or county boards of education, state and local education agencies, national and state legislators, and the U.S. Department of Education. They also include interest groups, such as representatives of minority groups, partisan state legislators, and representatives of the teachers' organizations.

Thus, although we argue that the primary responsibility, authority, and resources for collecting data on teachers be lodged in the NCES, *designing* that system requires the participation of the major users of those data. A participatory process is a slow process, but it will increase the utility and political fairness of the ultimate data system. It will also increase the chances that state, district, and association groups will co-operate with the NCES in implementing the system.

Supplementary Documents

Committee on National Statistics, National Academy of Sciences. "Preliminary Compilation of Descriptions of National Data Sets Relating to Supply of and Demand for Precollege Science and Mathematics Teachers." Unpublished paper. Washington, D.C., August, 1984.

Reisman, A. et al. "On the Voids in U.S. National Education Statistics." Unpublished paper. Cleveland, Ohio: Case Western Reserve, February, 1985.

Stern, Joyce D., et al. "Report of the Planning Group on Teaching and Teachers." Unpublished paper. Washington, D.C.: The National Center for Education Statistics, February, 1985.